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(54) **TWO-BEAM SEMICONDUCTOR LASER APPARATUS**

(75) Inventors: **Yasuhiro Watanabe**, Tottori (JP); **Kouji Ueyama**, Tottori (JP); **Shinichirou Akiyoshi**, Tottori (JP)

(73) Assignees: **Sanyo Electric Co., Ltd.**, Osaka (JP); **Tottori Sanyo Electric Co., Ltd.**, Tottori (JP)

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See application file for complete search history.

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Primary Examiner—Minsun Harvey
Assistant Examiner—Yuanda Zhang
(74) *Attorney, Agent, or Firm*—McDermott Will & Emery LLP

(57) **ABSTRACT**

A two-beam semiconductor laser device **10** includes: a two-beam semiconductor element LDC having a first and a second semiconductor laser elements LD**1** and LD**2** that can be driven independently and that are formed integrally on a substrate; and a submount **63** having, mounted on a front part thereof, the two-beam semiconductor laser element LDC with the light-emitting face thereof directed forward and having a first and a second electrode pads **64** and **65** connected to electrodes **61** and **62** of the first and second semiconductor laser element LD**1** and LD**2** by being kept in contact therewith. The first and second electrode pads **64** and **65** are formed to extend farther behind the two-beam semiconductor laser element LDC, and wires **14** and **16** are wire-bonded behind the two-beam semiconductor laser element LDC.

6 Claims, 10 Drawing Sheets

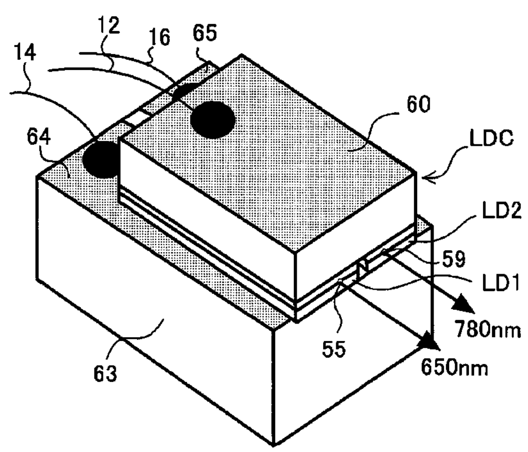

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FIG.1

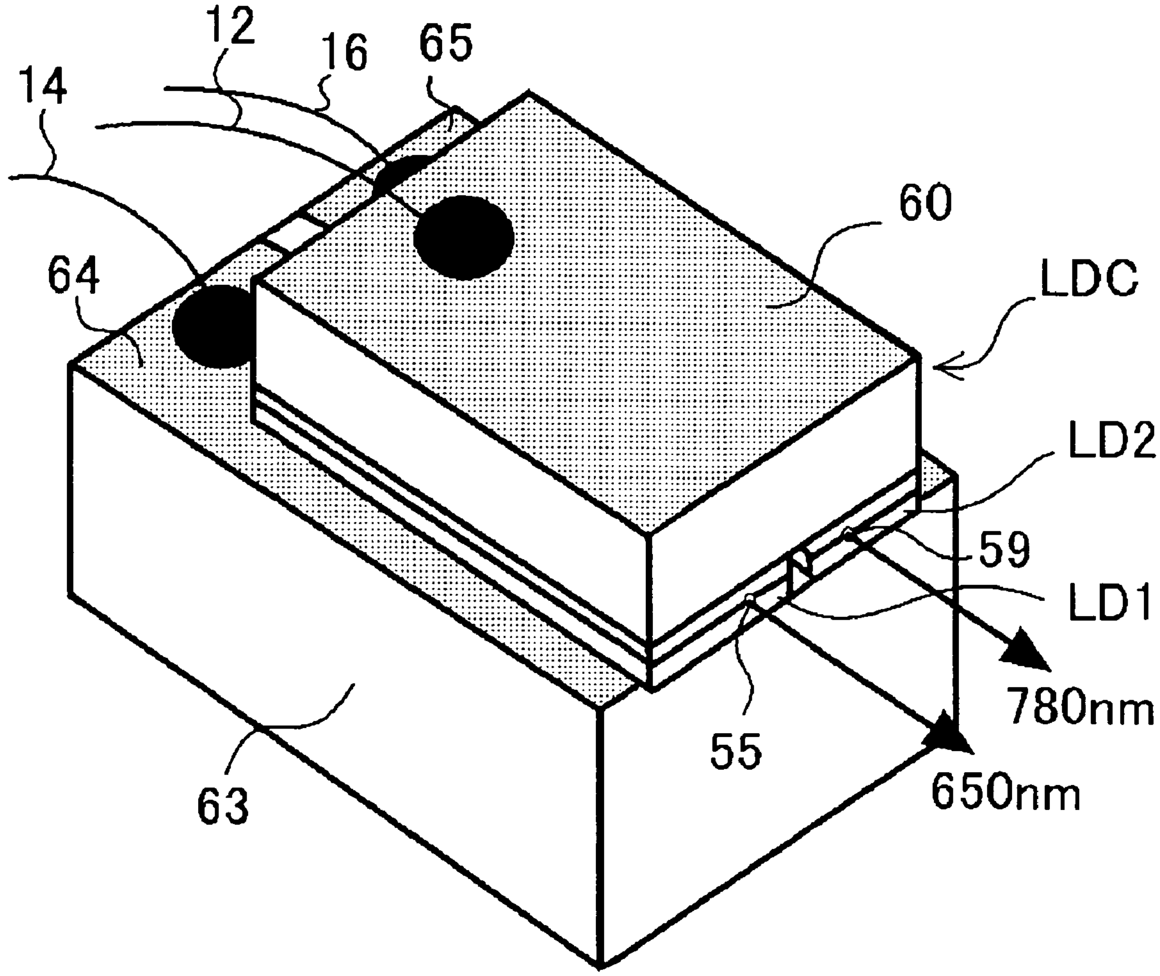


FIG.2

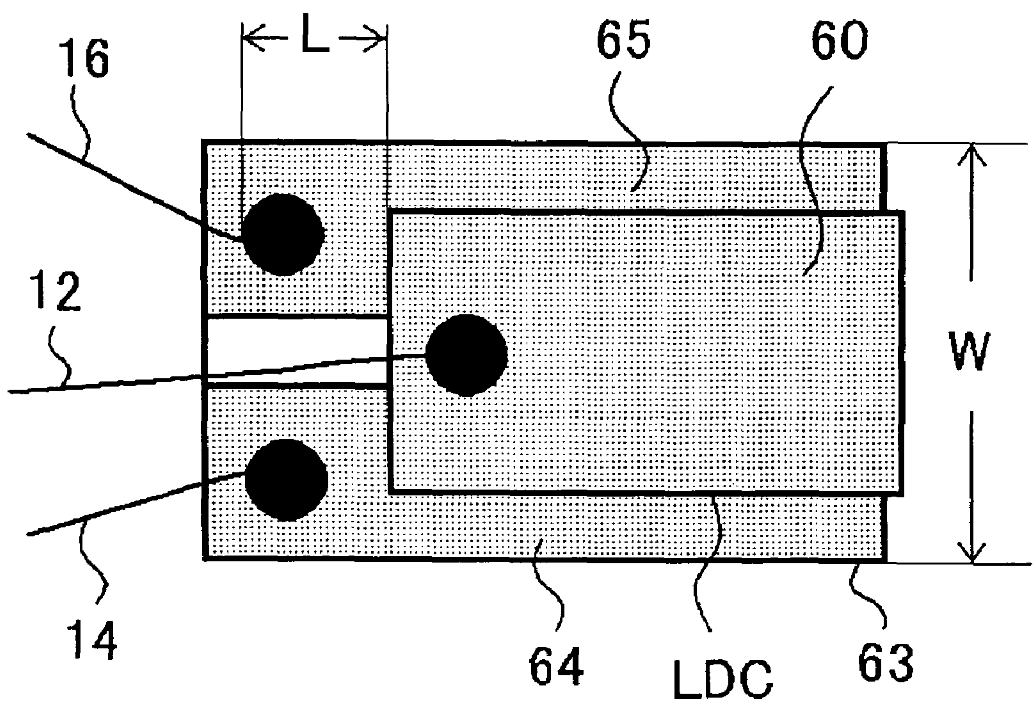


FIG.3

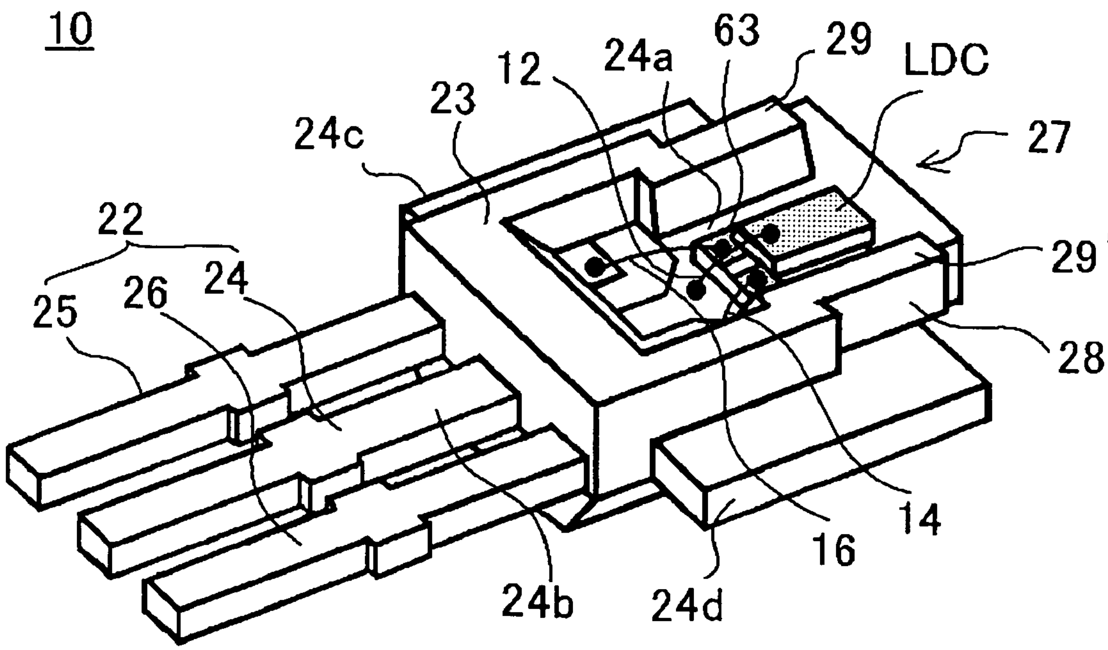


FIG.4

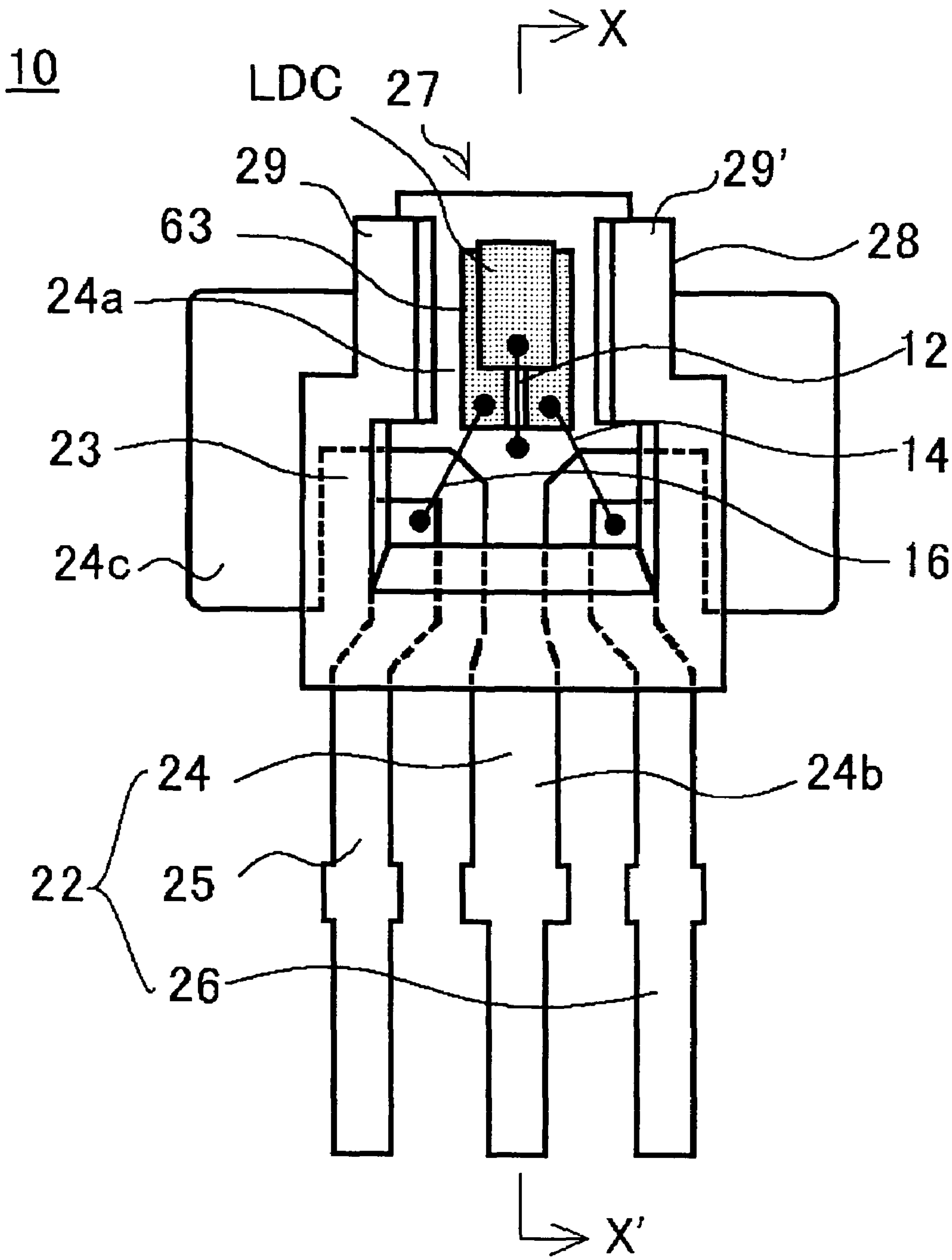


FIG.5

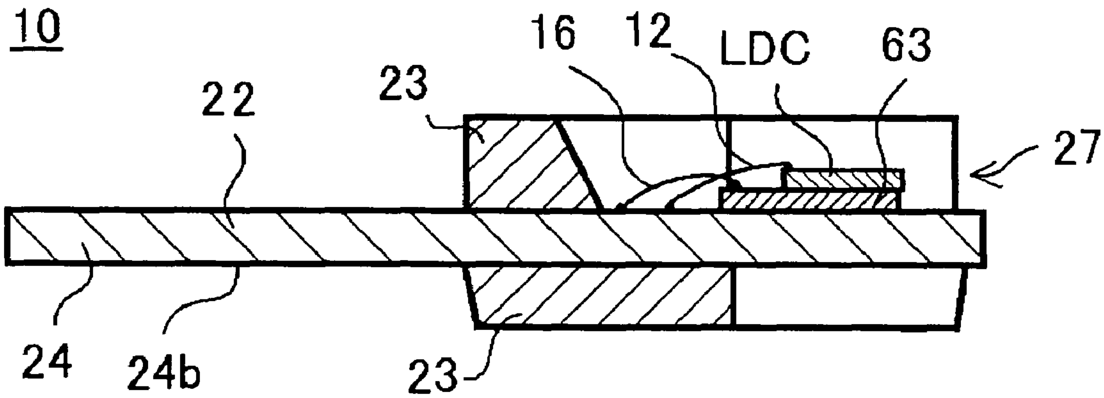


FIG.6

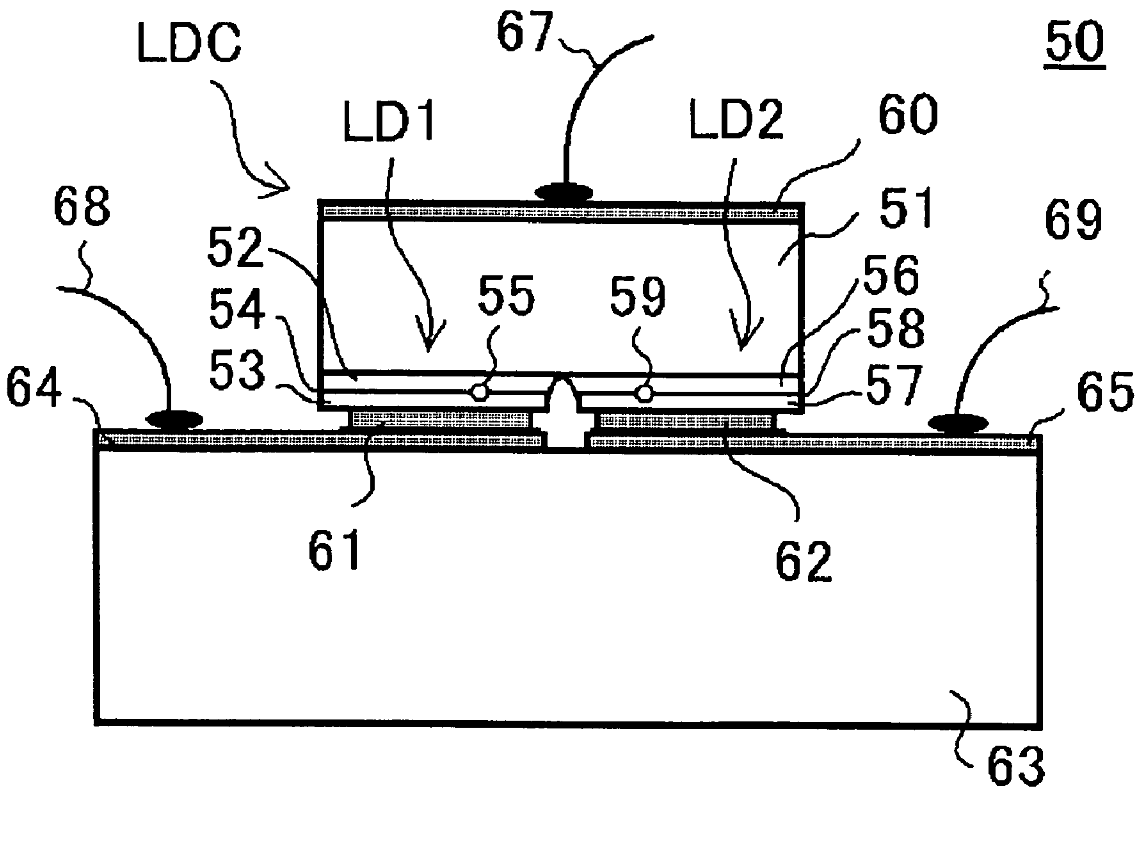


FIG.7

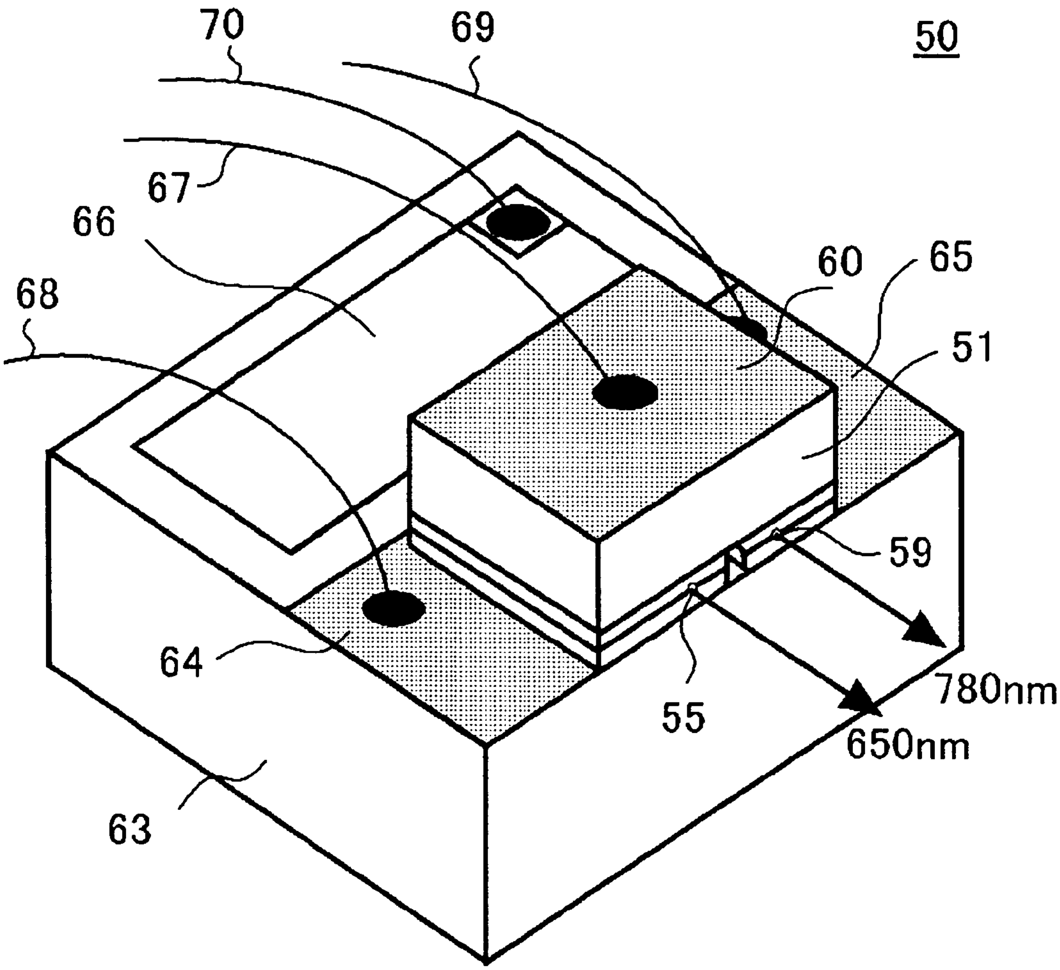


FIG.8

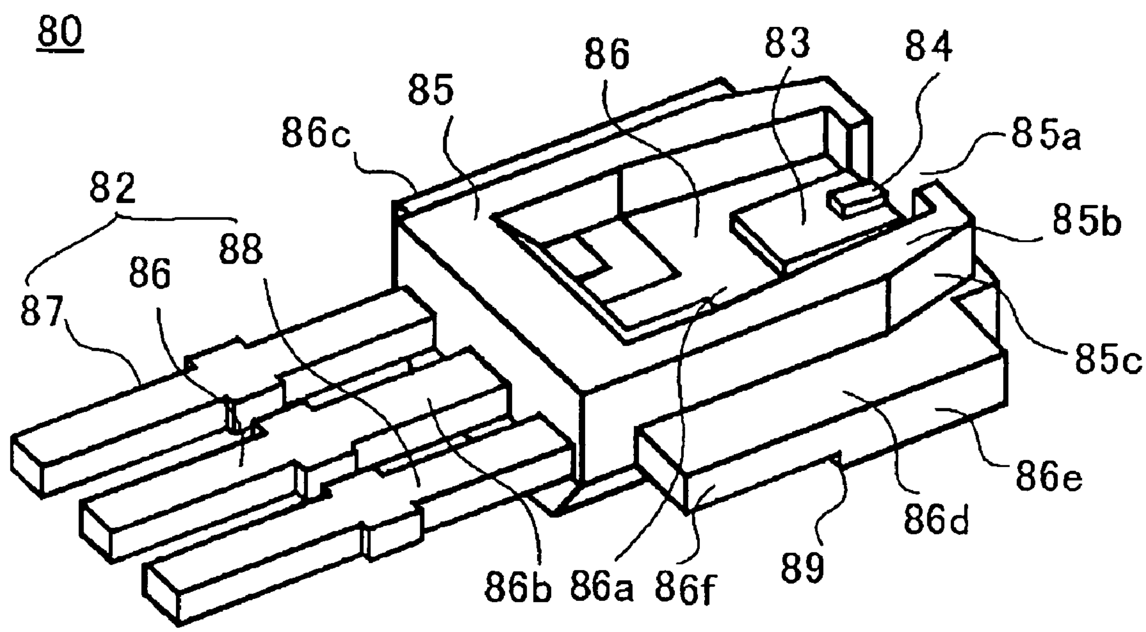


FIG.9

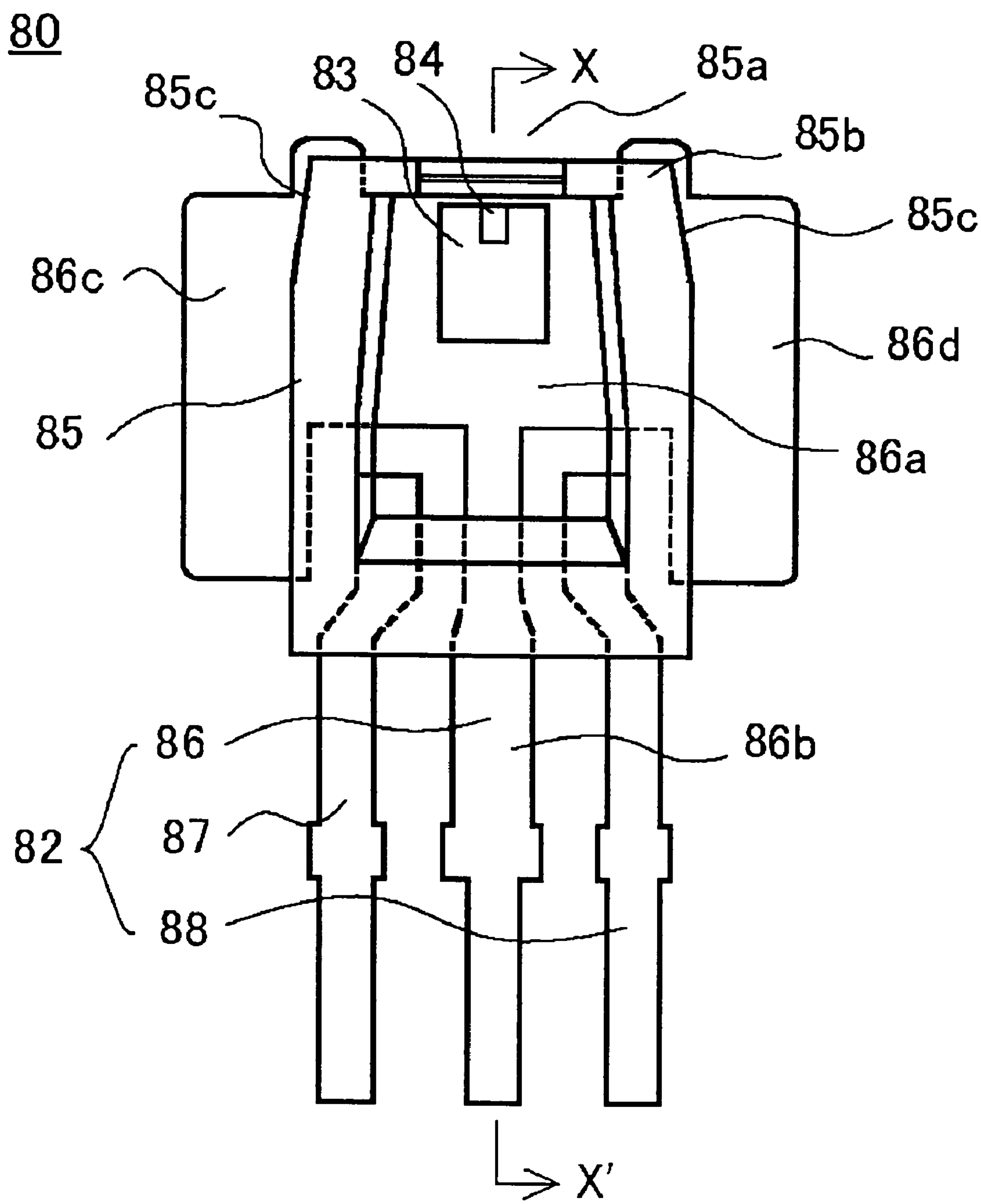
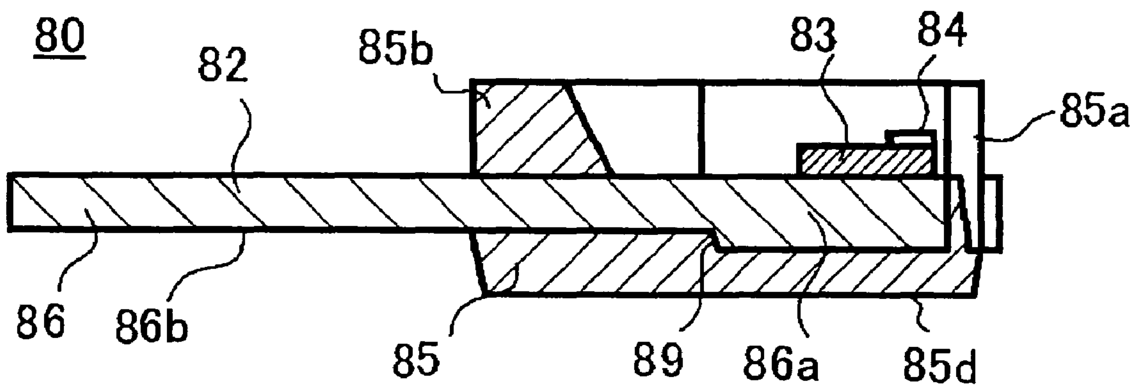


FIG.10



TWO-BEAM SEMICONDUCTOR LASER APPARATUS

This application is the U.S. National Phase under 35 U.S.C. §371 of International Application No. PCT/JP204/015011, filed Oct. 12, 2004, which in turn claims the benefit of Japanese Application No. 2003-355478, filed Oct. 15, 2003, the disclosures of which Applications are incorporated by reference herein in their entirety.

TECHNICAL FIELD

The present invention relates to a two-beam semiconductor laser device, and more particularly to a single-mode two-beam semiconductor laser device that employs a package composed of a frame and a resin member and that can emit laser light of two wavelengths individually.

BACKGROUND ART

As optical recording media, there have been known, among others, compact discs (CDs), recordable compact discs (CD-Rs), rewritable compact discs (CD-RWs), and as those offering higher recording densities, digital versatile discs (DVDs) and recordable DVDs. To record and play back, among these recording media, at least DVDs, CDs, CD-Rs, and CD-RWs, it is necessary to use, as the light source for optical pickups, one capable of emitting laser light of wavelengths 650 nm and 780 nm.

The laser light of a wavelength of 650 nm is for playback of DVDs, and the laser light of a wavelength of 780 nm is for playback of CDs and for recording and playback of CD-Rs and CD-RWs. The laser light of a wavelength of 650 nm may be used for recording of recordable DVDs. On the other hand, the recent demands for faster recording have been requiring higher-output light sources.

As a light source for incorporation in an optical pickup, there has been known a two-beam semiconductor laser device that can emit a laser light of wavelengths 650 nm and 780 nm from a single package. By incorporating a two-beam semiconductor laser device into an optical pickup, it is possible to make the optical pickup compact and to simplify the assembly thereof.

FIG. **6** and FIG. **7** are a front view and a perspective view respectively, showing a substantial part of a conventional two-beam semiconductor laser device. The two-beam semiconductor laser device **50** has a two-beam semiconductor laser element LDC mounted on a submount **63**. The two-beam laser element LDC is integrated on a single substrate **51**, with a first semiconductor laser element LD**1** and a second semiconductor laser element LD**2** formed separately from each other.

The substrate **51** is formed of, for example, n-type GaAs. The first semiconductor laser element LD**1** is formed of, for example, an AlGaInP semiconductor, and outputs laser light of a wavelength of 650 nm. The second semiconductor laser element LD**2** is formed of, for example, an AlGaAs semiconductor and outputs a laser light of a wavelength of 780 nm. The specific details of the structures of the first, AlGaInP, semiconductor laser element LD**1** and the second, AlGaAs, semiconductor laser element LD**2** are disclosed in Patent Publications 1 and 2, and therefore, in this respect, only a brief description thereof will be given below.

The first, AlGaInP, semiconductor laser element LD**1** has an n-type AlGaInP semiconductor layer **52** formed on the n-type GaAs substrate **51**. On the n-type AlGaInP semiconductor layer **52**, a p-type AlGaInP semiconductor layer **53** is formed with a first junction layer **54** laid in between. The first junction layer **54** contains a single-quantum-well (SQW) or multiple-quantum-well (MQW) structure, and has part thereof formed into a first light-emitting portion **55**.

Likewise, the second, AlGaAs, semiconductor laser element LD**2** has an n-type AlGaAs semiconductor layer **56** formed on the n-type GaAs substrate **51**. On the n-type AlGaAs semiconductor layer **56**, a p-type AlGaAs semiconductor layer **57** is formed with a second junction layer **58** laid in between. The second junction layer **58** contains the same structure as the first junction layer **54**, and has part thereof formed into a second light-emitting portion **59**.

On the back face of the substrate **51**, an n-side common electrode **60** is formed. On the top face of the first semiconductor laser element LD**1**, a first p-side electrode **61** is formed. On the top face of the second semiconductor laser element LD**2**, a second p-side electrode **62** is formed.

On the face of the submount **63** to which the two-beam semiconductor laser element LDC is fixed, a first electrode pad **64** and a second electrode pad **65** are formed separate from each other by patterning. The first and second p-side electrodes **61** and **62** of the two-beam semiconductor laser element LDC are fixed to the first and second electrode pads **64** and **65**, respectively. This configuration enables the first and second semiconductor laser elements LD**1** and LD**2** to be driven individually.

The two-beam semiconductor laser element LDC has a so-called junction-down structure; that is, it has the first and second junction layers **54** and **58** located close to the submount **63**. This enables the first semiconductor laser element LD**1** and the second semiconductor laser element LD**2** to dissipate heat efficiently. Thus, the submount **63** serves as a heatsink, and thereby helps stabilize the operation of and increase the output of the two-beam semiconductor laser element LDC.

Behind the two-beam semiconductor laser element LDC on the submount **63**, a photodetector **66** such as a photodiode is fitted. According to what is detected by the photodetector **66**, the light emission output of the two-beam semiconductor laser element LDC is controlled.

The submount **63**, on which the two-beam semiconductor laser element LDC is fixed, is fixed to a heatsink plate or a leadframe (not shown), and to the n-side common electrode **60** of the two-beam semiconductor laser element LDC, a wire **67** is connected at one end thereof. One end of a wire **68** and one end of a wire **69** are connected to the first electrode pad **64** and the second electrode pad **65**, respectively. One end of a wire **70** is connected to the photodetector **66**. The other ends of the wires **67** to **70** are connected to lead terminals (not shown). In this way, the two-beam semiconductor laser device **50** is fabricated.

In the two-beam semiconductor laser device **50** structured as described above, the first semiconductor laser element LD**1** can be driven independently by passing a current between the first p-side electrode **61** and the n-side common electrode **60**; the second semiconductor laser element LD**2** can be driven independently by passing a current between the second p-side electrode **62** and the n-side common electrode **60**. Thus by driving the first semiconductor laser element LD**1**, laser light of wavelength of 650 nm can be produced, and by driving the second semiconductor laser element LD**2**, laser light of wavelength of 780 nm can be produced.

Known semiconductor laser devices typically use can packages or frame packages. In a semiconductor laser device using a can package, leads are fitted one-by-one to a metal stem, and a laser element is mounted on the metal stem and is sealed with a cap. In a semiconductor laser device using a frame package, a semiconductor laser element is mounted on a metal frame, and these are then insert-molded. Semiconductor laser devices using frame packages have been attracting attention for their low cost and good mass productivity.

Compared with conventionally widely used semiconductor laser devices using can packages, however, semiconductor laser devices using frame packages offer poorer heat dissipation. For this reason, semiconductor laser devices using frame packages are now mostly used for infrared laser devices. Further improvements are required so as to make semiconductor laser devices using frame packages usable as high-output laser devices for use with CD-Rs and CD-RWs, red laser devices for use with DVDs, two-wavelength laser devices, or blue laser devices operating at high operating voltages.

Patent Publication 3 discloses a semiconductor laser device using a frame package in which such an improvement has been made. FIG. **8** and FIG. **9** are a perspective view and a front view, respectively, of this type of semiconductor laser device using a frame package. FIG. **10** is a sectional view taken along line X-X' shown in FIG. **9**.

In the semiconductor laser device **80**, a submount **83** is arranged in a fixed position on the top face of a frame **82**. A semiconductor laser element **84** is arranged in a fixed position on the top face of the submount **83**. The frame **82** is formed of a metal having good thermal and electrical conductivity, such as copper, iron, or an alloy of either, and is formed into a plate. The frame **82** includes a main frame **86** on which the semiconductor laser element **84** is mounted and sub frames **87** and **88** for wiring that are independent of the main frame **86**. The main frame **86** and the sub frames **87** and **88** are integrated into a frame package by being molded in a resin-molded member **85** that is electrically insulative.

The main frame **86** includes an element mount portion **86***a*, a lead portion **86***b* and wing portions **86***c* and **86***d*. On the element mount portion **86***a*, the submount **83** is mounted. The lead portion **86***b* serves as a current path. The wings **86***c* and **86***d* are formed to project to the left and right, respectively, for the purpose of heat dissipation and positioning. In the main frame **86**, a thick-walled section **86***e* and a thin-walled section **86***f* are formed. The thick-walled section **86***e* is formed by thickening a front part of the element mount portion **86***a* and front parts of the wing portions **86***c* and **86***d*. The thin-walled section **86***f* is formed by thinning the lead portion **86***b* and rear parts of the wing portions **86***c* and **86***d*.

The sub frames **87** and **88** are formed to be thin-walled like the lead portion **86***b*. This enables the lead portion **86***b* and the sub frames **87** and **88** to be finely processed with ease when the frame **82** is punched out by pressing. Therefore, it is possible to make the semiconductor laser device **80** compact by keeping the intervals between the lead portion **86***b* and the sub frames **87** and **88** short.

The resin-molded member **85** is formed by insert molding in such a manner that it sandwiches the frame **82**, from above the front face and below the back face of the frame **82**. On the front face of the resin-molded member **85** is formed a laser output window **85***a* through which laser light is emitted, as well as an enclosure **85***b* that is U-shaped so as to be open frontward. Taper faces **85***c* are formed in front-end parts of left and right side portions of the enclosure **85***b*. The taper faces **85***c* permit the semiconductor laser device **80** to be inserted smoothly to be arranged in a predetermined position. The back face of the resin-molded member **85** is formed to be a flat surface **85***d* that covers the element mount portion **86***a*, and has substantially the same outer shape (hexagonal shape) as the enclosure **85***b* located on the front face of the resin-molded member **85**.

The resin-molded member **85** does not cover the part of the element mount portion **86***a* of the main frame **86** in the enclosure **85***b*, nor does it cover the sub frames **87** and **88**. Thus, in these locations, the surfaces of the main frame **86** and the sub frames **87** and **88** are exposed. On the exposed part of the element mount portion **86***a*, the semiconductor laser element **84** is arranged and fixed, with the submount **83** placed in between. Subsequently, the semiconductor laser element **84** is connected to the main frame **86** with a wire (not shown), and the submount **83** is connected to the sub frames **87** and **88** with wires (not shown).

The submount **83** is built as a light receiving element whose base material is Si. This makes it possible to monitor the light emitted from the rear face of the semiconductor laser element **84**. Instead of Si, a ceramic or metal material that has high thermal conductivity may be used, such as AlN, SiC, or Cu. The submount **83** is fixed to the element mount portion **86***a*, for example, with a solder material such as Pb—Sn, Au—Sn, or Sn—Bi, or with Ag paste. The semiconductor laser element **84** is fixed to the submount **83**, in a predetermined position thereon, for example, with a solder material such as Au—Sn or Pb—Sn, or with Ag paste.

Structured as described above, the semiconductor laser device **80** using a frame package offers the following advantages: since the surface of the semiconductor laser element **84** is exposed, it offers good heat dissipation; it has a simple structure, and is therefore suitable for mass production.

Patent Publication 1: JP-A-H11-186651 (Claims, paragraphs [0017] to [0023], FIG. 1)

Patent Publication 2: JP-A-2002-329934 (Claims, FIG. 1, FIG. 4)

Patent Publication 3: JP-A-2002-43679 (paragraphs [0010] to [0022], FIG. 1, FIG. 2, FIG. 4)

DISCLOSURE OF THE INVENTION

Problems to be Solved by the Invention

A semiconductor laser device is usually operated in single mode. In a case where a semiconductor laser device is used in an optical pickup for recording and playing back optical discs, however, it needs to be operated in multiple mode for playback to cope with return light from the optical disc. For this purpose, multiple mode is emulated by high-frequency modulation, and, when this is done, the semiconductor laser device needs to be matched with the high-frequency modulation.

Disadvantageously, the conventional semiconductor laser device **80** using a frame package disclosed in Patent Publication 3 has, for better heat dissipation and easy wire bonding, the submount **83** formed far larger than the semiconductor laser element **84**. Moreover, the lead portion **85***b* and the sub frames **87** and **88** are located far from the submount **83** and the semiconductor laser element **84**. Thus, longer wires are needed than in a semiconductor laser device using a metal can package.

When a semiconductor laser device is operated by high-frequency modulation, since the wires have varying inductances according to the length thereof, the wires need to be made as short as possible. Thus, inconveniently, the semiconductor laser device **80** cannot be stably operated by high-frequency modulation.

This inconvenience is experienced even with a two-beam semiconductor laser device if it uses a frame package. In addition, as shown in FIG. **7** described above, the two-beam semiconductor laser device **50** has the photodetector **66** arranged behind the two-beam semiconductor laser element LDC, and thus has four terminals.

This requires even longer wires to be used as the wires **67** to **69** bonded to the n-side common electrode **60** and the first and second electrode pads **64** and **65**, and thus inconveniently causes the inductances thereof to vary unduly greatly.

Furthermore, the presence of the photodetector **66** makes it difficult to miniaturize the two-beam semiconductor laser device **50**. Moreover, since the space behind the two-beam semiconductor laser element LDC is occupied by the photodetector **66**, the wires **68** and **69** are connected to the first and second electrode pads **64** and **65** at the sides of the two-beam semiconductor laser element LDC. This makes the submount **63** unduly wide, which makes it more difficult to miniaturize the two-beam semiconductor laser device **50**.

Incidentally, whereas conventional semiconductor laser elements are about 300 to 400 μm long, recent higher-output semiconductor laser elements are about 1 to 1.5 mm long, that is, they are three to five times longer than conventional ones. This makes the submount **63** is even larger. Under these circumstances, there is a need for a structure of a two-beam semiconductor laser device in which a two-beam semiconductor laser device can be made compact.

In search of a solution to the inconveniences experienced in the fabrication of a two-beam semiconductor laser device made particularly compact with a frame package as described above, the inventors of the present invention have conducted various studies, which have led to the present invention.

An object of the present invention is to provide a single-mode two-beam semiconductor laser device that permits size reduction and that can be stably operated in multiple mode.

Means for Solving the Problem

To achieve the above object, according to the present invention, a two-beam semiconductor laser device is provided with: a two-beam semiconductor element having a first and a second semiconductor laser elements that can be driven independently and that are formed integrally on a substrate; and a submount having, mounted on a front part thereof, the two-beam semiconductor laser element with a light-emitting face thereof directed forward and having a first and a second electrode pads connected to electrodes of the first and second semiconductor laser element by being kept in contact therewith. Here, the first and second electrode pads are formed to extend farther behind the two-beam semiconductor laser element and are wire-bonded behind the two-beam semiconductor laser element.

According to the present invention, in the two-beam semiconductor laser device structured as described above, the first and second electrode pads are wire-bonded at the rear end of the submount.

According to the present invention, in the two-beam semiconductor laser device structured as described above, the distance from the rear end of the two-beam semiconductor laser element to the position where the first and second electrode pads are wire-bonded is 300 μm or shorter. Theoretically, it is preferable that the lower limit value of the distance from the rear end of the two-beam semiconductor laser element to the position where the first and second electrode pads are wire-bonded be as small as possible. However, if the distance is too small, wire bonding cannot be carried out easily. Thus, the distance should be determined properly, taking into consideration the diameter of the wire and the size of the jig for wire bonding. The wire can be made short enough even if the distance is over 300 μm. However, in such

a case, the size of the submount is disadvantageously large, and thus the upper limit value of the distance should be 300 μm.

According to the present invention, in the two-beam semiconductor laser device structured as described above, the lateral length of the submount is 400 μm or more but 700 μm or less. If the lateral length of the submount is less than 400 μm, wire bonding cannot be carried out easily and a short circuit is liable to occur between the two electrode pads disposed on the submount. On the other hand, if the lateral length of the submount is over 700 μm, there is no longer any advantage from the view point of miniaturization of the two-beam semiconductor laser device, and for this reason, the upper limit value of the lateral length of the submount should be 700 μm.

According to the present invention, in the two-beam semiconductor laser device structured as described above, the submount is mounted in a package composed of a frame and a resin member.

According to the present invention, the two-beam semiconductor laser device structured as described above is built as a three-terminal two-beam semiconductor laser device having three terminals.

Advantages of the Invention

According to the present invention, the first and second electrode pads are formed to extend farther behind the two-beam semiconductor laser element, and are wire-bonded behind the two-beam semiconductor laser element. This helps reduce the lateral length of the submount, and thus helps make the two-beam semiconductor device compact. In addition, since the position where the wire bonding is performed is farther behind, the wires used here can be made shorter than conventionally needed.

This permits the inductances of the wires to be made lower by about 20% than is conventionally usual. Thus, the two-beam semiconductor laser device can be stably operated in multiple mode emulated by high-frequency modulation.

According to the present invention, since the first and second electrode pads are wire-bonded at the rear end of the submount, no photodetector is arranged behind the submount, and thus the wires can be made even shorter to permit the two-beam semiconductor laser device to be stably operated in multiple mode emulated by high-frequency modulation.

According to the present invention, the distance from the rear end of the two-beam semiconductor laser element to the position where the first and second electrode pads are wire-bonded is 300 μm or less, and this helps make the submount compact. Thus, the two-beam semiconductor laser element is arranged close to the rear end of the submount **63**, and this helps reduce the lengths of the wires that are connected to the two-beam semiconductor laser element. Thus, the two-beam semiconductor laser device can be stably operated in multiple mode emulated by high-frequency modulation.

According to the present invention, since the lateral length of the submount is 400 μm or more but 700 μm or less, the two-beam semiconductor laser device can be made compact, and wire-bonding can be carried out easily.

According to the present invention, the submount is mounted in a package composed of a frame and a resin member, and this permits the two-beam semiconductor laser device to be compact, inexpensive, and suitable for mass production.

According to the present invention, the two-beam semiconductor laser device is built as a three-terminal two-beam semiconductor laser device, and this helps make the two-beam semiconductor laser device more compact as much more as the number of terminals is reduced, than is conventionally usual.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** A perspective view showing a two-beam semiconductor laser element of a two-beam semiconductor laser device embodying the present invention.

FIG. **2** A plan view showing a two-beam semiconductor laser element of a two-beam semiconductor laser device embodying the present invention.

FIG. **3** A perspective view showing a two-beam semiconductor laser device embodying the present invention.

FIG. **4** A plan view showing a two-beam semiconductor laser device embodying the present invention.

FIG. **5** A sectional view taken along line X-X' shown in FIG. **4**.

FIG. **6** A front view showing a conventional two-beam semiconductor laser element.

FIG. **7** A perspective view showing a conventional two-beam semiconductor laser element.

FIG. **8** A perspective view showing a conventional two-beam semiconductor laser device.

FIG. **9** A plan view of the semiconductor laser device shown in FIG. **8**.

FIG. **10** A sectional view taken along line X-X' shown in FIG. **9**.

LIST OF REFERENCE SYMBOLS

10, **50** two-beam semiconductor laser device
12, **14**, **16**, **67**, **68**, **69** wire
22, **82** frame
23, **85** resin-molded member
24, **86** main frame
24*a*, **86***a* element mount portion
25, **26**, **87**, **88** sub frame
27, **85***a* laser output window
28, **85***b* enclosure
29, **29'** end part
55 first light-emitting portion
59 second light-emitting portion
60 n-side common electrode
61 first p-side electrode
62 second p-side electrode
63 submount
64 first electrode pad
65 second electrode pad
66 photodetector
80 semiconductor laser device
LDC two-beam semiconductor laser element
LD**1** first semiconductor laser element
LD**2** second semiconductor laser element

BEST MODE FOR CARRYING OUT THE INVENTION

An embodiment of how the present invention is carried out will be described below with reference to the accompanying drawings. It should be understood, however, that the embodiment presented below is simply intended to give an example of a two beam semiconductor laser device that embodies the technical idea of the present invention, and therefore the two-beam semiconductor laser device specifically described below is not intended to limit in any way the manner in which to carry out the present invention. That is, the present invention finds wide application in the technical fields to which the appended claims are directed.

FIG. **1** and FIG. **2** are a perspective view and a plan view, respectively, showing a substantial part of a two-beam semiconductor laser device embodying the present invention. For the sake of ease of description, such portions as find their counterparts in FIG. **6** and FIG. **7** described above are identified with common reference numerals, and overlapping descriptions will not be repeated. The two-beam semiconductor laser element LDC has a junction-down structure where a junction portion that includes a first and a second light-emitting portions **55** and **59** is fixed close to a submount **63**.

A first semiconductor laser element LD**1** that emits laser light of a wavelength of 650 nm for recordable DVDs is arranged on the left side as seen from the front in FIG. **1**. A second semiconductor laser element LD**2** that emits laser light of a wavelength of 780 nm for CDs/CD-Rs is placed on the right side as seen from the front in FIG. **1**. Between the first and second semiconductor laser elements LD**1** and LD**2** is formed a groove to separate them from each other.

The submount **63** is formed of a ceramic or metal material that has high thermal conductivity, such as AlN, SiC, Cu, or Si. On the top face of the submount **63** are disposed a first and a second electrode pads **64** and **65** that are formed by patterning of Ti—Pt—Au. A first p-side electrode **61** (see FIG. **6**) is disposed right under a first light-emitting portion (waveguide) **55** of the first semiconductor laser device LD**1**, and is fixed with solder such as Au—Sn onto the first electrode pad **64**.

Likewise, a second p-side electrode **62** (See FIG. **6**) is disposed right under a second light-emitting portion (waveguide) **59** of the second semiconductor laser device LD**2**, and is fixed with solder such as Au—Sn onto the second electrode pad **65**.

This enables the heat generated at the first and second semiconductor elements LD**1** and LD**2** to be efficiently conducted to the submount **63** via the first and second electrode pads **64** and **65**, and then dissipated.

The two-beam semiconductor laser element LDC and the submount **63** are each formed in the shape of a flat box that is elongate in the direction of the emission of laser light. The lateral length W of the submount **63** is equal to or slightly larger than the lateral length of the two-beam semiconductor laser element LDC.

The submount **63** is extended in the direction pointing away from the main-laser-light-emitting face of the two-beam semiconductor laser element LDC. In this way, the two-beam semiconductor laser element LDC is arranged on a front part of the submount **63** with the light-emitting face of the former facing forward, and a rear part of the submount **63** serves as an wire bonding area.

Incidentally, in the submount **63** of this embodiment, no photodetector **66** for monitoring (see FIG. **7**) as used in the conventional example is disposed. In a high-output semiconductor laser element, to enhance the output of laser light, the face pointing away from the laser-light-emitting direction is given a higher reflectivity. This helps reduce the amount of laser light emitted backward, and thus eliminates the need to bother to integrate the photodetector **66** into the submount **63**. That is, the photodetector **66** may be omitted.

At the rear end of the submount **63**, to the first and second electrode pads **64** and **65**, one ends of wires **14** and **16** for electrically connecting them to lead terminals (**25** and **26**, see FIG. **3**) are wire-bonded. To an n-side common electrode **60** formed on the back face of the two-beam semiconductor laser element LDC, one end of a wire **12** for electrically connecting the n-side common electrode to a lead terminal (**24***b*, see FIG. **3**) is wire-bonded.

The wires **14** and **16** are wire-bonded where the distance L from the rear end of the semiconductor laser element LDC is 300 μm or less. The shorter the distance L is, the shorter the submount **63** can be made. Therefore, the two-beam semiconductor laser element LDC is disposed close to the rear end of the submount **63**, and thus the wire **12** can be made short. The distance L may be determined properly taking into consideration the diameters of the wires **14** and **16** and the size of the jig for wire bonding such as an automatic bonder.

The lateral length W of the submount **63** may be determined taking into consideration the width of the first and second electrode pads **64** and **65**, and the distance between the first and second electrode pads **64** and **65**. The width of the first and second electrode pads **64** and **65** is properly determined taking into consideration the diameters of the wires **14** and **16** and the size of the jig for wire bonding such as an automatic bonder. The distance between the first and second electrode pads **64** and **65** should be long enough to achieve electrical separation between them. This helps reduce the lateral length W of the submount **63** to as small as about 400 μm in this embodiment. It is preferable that the lateral length W of the submount **63** be about 700 μm at most, though there is no specific reason that this should be so.

FIG. **3** and FIG. **4** are a perspective view and a front view, respectively, of the two-beam semiconductor laser device of this embodiment. FIG. **5** is a sectional view taken along line X-X' shown in FIG. **4**. In the two-beam semiconductor laser device **10**, the two-beam semiconductor laser element LDC and the submount **63** are mounted in a frame package composed of a three-terminal frame and a resin member.

In the two-beam semiconductor laser device **10**, the submount **63** is arranged and fixed on the top face of a frame **22**. On the top face of the submount **63**, the two-beam semiconductor laser element LDC is arranged and fixed.

The frame **22** is formed of a metal having good thermal and electrical conductivity, such as copper, iron, or an alloy of either, and is formed into a plate. In addition, the frame **22** includes a main frame **24** on which the two-beam semiconductor laser element LDC is mounted and sub frames **25** and **26** for wiring that are independent of the main frame **24**. The main frame **24** and the sub frames **25** and **26** are integrated into a frame package by being molded in a resin-molded member **23** that is electrically insulative.

The main frame **24** has an element mount portion **24***a*, a lead portion **24***b*, and wings **24***c* and **24***d*. On the element mount portion **24***a*, the submount **63** is mounted.

The lead portion **24***b* serves as a current path. The wings **24***c* and **24***d* are formed to project to the left and right, respectively, for the purpose of heat dissipation and positioning.

The lead portion **24***b* and the sub frames **25** and **26** are formed to be thin-walled, and this enables them to be finely processed with ease when the frame **22** is punched out by pressing. Therefore, it is possible to make the semiconductor laser device **10** compact by keeping the intervals between the lead portion **24***b* and the sub frames **25** and **26** short.

The resin-molded member **23** is formed by insert molding in such a manner that it sandwiches the frame **22**, from above the front face and below the back face of the frame **22**. On the front face of the resin-molded member **23** is formed an enclosure **28** that has a laser output window **27** through which laser light is emitted and that is U-shaped so as to be open frontward. The front part of the enclosure **28** has a smaller width than the rear part thereof, and end parts **29** and **29'** disposed at the either end of the front part of the enclosure **28** extend parallel to the optical axis of the two-beam semiconductor laser element LDC. The end parts **29** and **29'** with a smaller width in between than the rear part of the enclosure **28** permit the two-beam semiconductor laser device **10** to be inserted smoothly to be arranged in a predetermined position.

The back face of the resin-molded member **23** is so formed as to expose the part of the back face of the main frame **24** facing the submount **63** so as to enclose that part. This helps enhance heat dissipation efficiency.

The resin-molded member **23** does not cover the part of the element mount portion **24***a* of the main frame **24** in the enclosure **28**, nor does it cover the sub frames **25** and **26**. Thus, in these locations, the surfaces of the main frame **24** and the sub frames **25** and **26** are exposed. On the exposed part of the element mount portion **24***a*, the semiconductor laser element LDC is arranged and fixed, with the submount **63** placed in between. Subsequently the two-beam semiconductor laser element LDC is connected to the lead portion **24***b* with the wire **12**, and the submount **63** is connected to the sub frames **25** and **26** with the wires **14** and **16**. Incidentally, the submount **63** is fixed to the frame **24**, for example, with a solder material such as Pb—Sn, Au—Sn, or Sn—Bi, or with Ag paste.

In the above structured two-beam semiconductor laser device **10**, the first and second electrode pads **64** and **65** are formed to extend farther behind the two-beam semiconductor laser element LDC and are wire-bonded behind the two-beam semiconductor laser element LDC. This helps make the lateral length W of the submount **63** far smaller than in the conventional example shown in FIG. **7**, and thereby to make the two-beam semiconductor device compact.

Furthermore, since the position where the wire bonding is performed is farther behind, the wire **14** used between the first electrode pad **64** and the sub frame **26** and the wire **16** used between the second electrode pad **65** and the sub frame **25** can be made shorter than conventionally needed. This permits the inductances of the wires **14** and **16** to be made lower than is conventionally usual. Thus, the two-beam semiconductor laser device **10** can be stably operated in multiple mode emulated by high-frequency modulation. Moreover, since no photodetector is arranged behind the submount **63**, the first and second electrode pads **64** and **65** are wire-bonded at the rear end of the submount **63**. Thus, the wires **14** and **16** can be made even shorter.

In addition, the position where wire bonding is performed is close to the rear end part of the two-beam semiconductor laser element LDC. This permits the two-beam semiconductor laser element LDC to be disposed close to the rear end of the submount **63**, and thus helps shorten the length of the wire **12** that connects the two-beam semiconductor laser element LDC to the main frame **24**. Thus, the two-beam semiconductor laser device can be more stably operated in multi mode emulated by high-frequency modulation.

The two-beam semiconductor laser device **10** fabricated according to this embodiment is used as a three-terminal high-output two-wavelength semiconductor laser device. The size of the two-beam semiconductor laser device **10** is as follows: the width of the package at the front end thereof (the width of the enclosure **28** as measured at the end parts **29** and **29'** in FIG. **3** and FIG. **4**) is 2.7 mm, the-rear end width is 3.8 mm, and the length is 3.5 mm.

In contrast, it cannot be helped that a conventional high-output two-wavelength semiconductor laser device, even if mounted in a three-terminal package without taking the photodetector into consideration, is large-sized to secure a space that accepts the lateral length of the submount and that permits assembly. Thus, the smallest dimensions possible are:

the width of the package at the front end thereof is 3.8 mm, the rear end width is 3.8 mm, and the length is 3.5 mm.

According to this embodiment, the wire bonding area at the side of the submount **63** can be ignored, and thus a compact package is realized that is smaller both in the front end width and in the area by about 30% as compared with conventional examples. In addition, it has been observed and confirmed that by making the wires **12**, **14**, and **16** shorter, the inductances of the wires can be made lower by about 20% than is conventionally usual.

INDUSTRIAL APPLICABILITY

The two-beam semiconductor laser device according to the present invention can be used for optical pickups that emit laser light of a plurality of wavelengths for recording or playback of DVDs, recordable DVDs, CDs, CD-Rs, or CD-RWs.

The invention claimed is:

1. A two-beam semiconductor laser device comprising:

a two-beam semiconductor element having first and second semiconductor laser elements that can be driven independently and that are formed integrally on a substrate; and

a submount having, mounted on a front part thereof, the two-beam semiconductor laser element with a light-emitting face thereof directed forward and having first and second electrode pads connected to electrodes of the first and second semiconductor laser elements by being kept in contact therewith,

wherein no photodetector is provided on the submount,

wherein the first and second electrode pads are formed to extend farther behind the two-beam semiconductor laser element, and are wire-bonded behind the two-beam semiconductor laser element at positions directly behind the two-beam semiconductor laser element with respect to a laser-light-emitting direction of the two-beam semiconductor element, and

wherein a lateral width of the submount along the front part of the submount is 400 μm or more but 700 μm or less.

2. The two-beam semiconductor laser device of claim **1**,

wherein the first and second electrode pads are wire-bonded at a rear end of the submount.

3. The two-beam semiconductor laser device of claim **1**,

wherein a distance from the rear end of the two-beam semiconductor laser element to a position where the first and second electrode pads are wire-bonded is 300 μm or shorter.

4. The two-beam semiconductor laser device of claim **1**, further comprising:

a metal frame;

wherein the submount is mounted directly on the frame, and

no photodetector is directly mounted on the frame.

5. The two-beam semiconductor laser device of claim **4**,

wherein the two-beam semiconductor laser device is built as a three-terminal two-beam semiconductor laser device having only three terminals.

6. The two-beam semiconductor laser device of claim **4**, further comprising:

three bonding wires, each bonded to a location behind the submount and to one of an electrode of the two-beam semiconductor element, the first electrode pad, and the second electrode pad.

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